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The Determinants of Trade Credit During and After the 2008 International Financial Crisis

Os Determinantes do Crédito Comercial Durante e Após a Crise Financeira Internacional de 2008

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ABSTRACT
This work analyses the determinants of trade credit granted and received and the effect of the 2008 financial crisis on it. Using a sample of 96,417 Portuguese SMEs from the non-financial sector for the period 2010–2019, we found that trade credit plays an important role in firms' financing policies. Firms with better access to the credit market act as financial intermediaries and grant financing to firms that have difficulty accessing credit. Moreover, the use of trade credit seems to be a substitute for bank financing. We also found that firms use trade credit as a marketing tool to increase their sales. Finally, we found a slump in credit granted to customers after the 2008 financial crisis, which seems to mimic the contraction in aggregate bank credit.
Keywords: Trade Credit; SMEs; Financing; Commercial policy.

JEL Classification: G32; L29; G01.

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1. Introduction[1]

Trade credit enables firms to separate the payment cycle from the delivery schedule. When looking for sources of financing, it is important to consider other funding options besides bank credit, especially trade credit. Indeed, the volume of trade credit is higher than short-term loans received from banks in all developed economies (Cuñat and García-Appendini, 2012).

Trade credit varies substantially across firms and industries. The main objective of this work is to analyze the determinants of trade credit, using a sample of Portuguese small and medium-sized enterprises (SMEs) from the non-financial sector for the period 2010–2019. This, in turn, enables us to test several theories of trade credit provided by the literature. In addition, we also test whether firms are more likely to use or apply for trade credit in response to an aggregate contraction in bank credit.

Since Meltzer's (1960) research, several studies have investigated the determinants of trade credit. This work adds to this literature by analyzing the determinants of trade credit in the context of Portugal. In particular, the study provides some important insights for corporate governance in a way that firms can decide on their trade credit behavior while considering the firm-specific characteristics. By this we mean that firms with better access to the credit market could act as financial intermediaries and grant financing to firms that have difficulty accessing credit. Further, trade credit received could be a substitute for bank financing. Trade credit may play an important role not only in financing policy, but also as a marketing tool to increase sales. Finally, policy makers should consider financing by firms as a key issue when aggregate bank credit shrinks, as firms may also reduce the credit extended to their customers.

2. Theories of Trade Credit

Trade credit can be defined as a source of short-term financing provided by suppliers to their customers. It allows the customer to purchase goods or services on credit and defer payment to a later date.

The balance sheets of most firms contain accounts receivable (i.e. financing granted to customers) as well as accounts payable (i.e. financing received from suppliers). For example, Garcia-Teruel and Martinez-Solano (2010) report that the accounts receivable (accounts payable) over assets ranged from 39.3% in Spain (28.5% in France) to 19.2% in Finland (13.2% in Finland) in the period 1996–2002. In the case of Portugal, Giannetti (2003) found that the amount of accounts payable represented up to three times other types of short-term debt in a sample of large firms from 1993 to 1997.

[1] A previous version of this work was presented by Pedro Jorge de Almeida e Silva as a Master's Thesis, under the title "Crédito Comercial nas PMEs Portuguesas: Análise das determinantes e dinâmicas de financiamento na indústria transformadora", under the supervision of Prof. Carlos Carreira, at the University of Coimbra, Faculty of Economics.

Why Does Trade Credit Exist? Several theories can be found in the literature to explain the existence and use of trade credit, based specially on financial, operational and commercial motives (Petersen and Rajan, 1997).

2.1. Financial motives

Close relationships between suppliers and customers can mitigate the information asymmetry between creditors and debtors. Suppliers have a comparative advantage over financial institutions regarding information acquisition, contract enforcement, and the liquidation process (Petersen and Rajan, 1997; Delannay and Weill, 2004; Huyghebaert, 2006). This advantage allows firms with easier access to credit markets to serve as financial intermediaries for firms with limited credit access.

Therefore, the level of trade credit will depend on the creditworthiness of the firm, and the availability and cost of financial resources from banks. We expect that firms with easier access to bank loans will grant more trade credit, while those with fewer financial options will resort more to trade credit from their suppliers. However, since suppliers have an information advantage, trade credit extension may be considered by banks as a signal of the quality of a borrower, and therefore induce banks to grant credit (Biais and Gollier, 1997). Consequently, trade credit and bank credit can be complementary and not substitutes, as stated above.

2.2. Operational motives

Trade credit enables firms to separate the payment cycle from the delivery schedule, reducing the transaction costs, especially in seasonal markets or with highly uncertain demand. Instead of overinvesting in fixed assets or holding excess inventory, firms can use trade credit to smooth demand (Ferris, 1981; Emery, 1987). Therefore, firms have operating motives to use trade credit—to stimulate sales in times of low demand. We thus expect that firms may use more trade credit when their sales growth is low.

However, sales growth is also a factor that affects the demand for finance in general, and for trade credit in particular. Therefore, we can also expect that firms with greater increases in sales will use more trade credit in order to finance their new investments (Garcia-Teruel and Martinez-Solano, 2010).

2.3. Commercial motives

There are also commercial motives for granting trade credit. Trade credit can be used by firms as a form of price discrimination. Prolonging the period of credit or increasing the discount for prompt payment effectively equates to a price reduction (Brennan et al., 1988). Firms operating with high contribution margins have a strong incentive to induce additional

sales without cutting the price by extending trade credit instead (Petersen and Rajan, 1997). Consequently, we expect firms with higher profit margins to grant more trade credit.

Another commercial motive for trade credit is its use by suppliers to offer an implicit guarantee of quality. Indeed, suppliers can transmit information about the quality of their products by agreeing to credit terms that allow their customers a period of evaluation (Smith, 1987; Lee and Stowe, 1993). Small firms, which are typically younger and lack a solid reputation in the market, tend to grant more trade credit than large firms, which benefit from a well-established reputation (Long et al., 1993). Therefore, we expect that firms with high product quality will offer more trade credit to their customers in order to allow them to evaluate product quality.

3. **Data and Methodology**

3.1. The dataset

The dataset used in this study was originally compiled by Carreira et al. (2022), who extracted the raw data from the Integrated Business Accounts System (SCIE, Portuguese acronym), administered by the Portuguese Statistical Office (INE). Our sample specifically covers the whole population of small and medium-sized firms operating in Portugal from 2010 to 2019, except for the financial sector, and education, health and cultural services. The SMEs are defined according to the requirements established by the European Commission recommendation 2003/361.[2]

After this preliminary filtering, the information obtained was refined. Observations with unreasonable values (*e.g.*, non-positive turnover or total assets) were discarded. In addition, we truncated 1% of the extreme ratios (percentiles 1 and 99) presented by the variables defined in the next section. Our final sample comprises an unbalanced panel of 96,417 firms making up 488,694 year-firm observations.

3.2. Model specification and description of variables

Firms using trade credit as both suppliers and customers (Petersen and Rajan, 1997). We will examine these two sides of trade credit by first looking at firms as lenders (suppliers) and then as borrowers (customers). As proxies for how much a firm lends to its customers and borrows from its suppliers, we use accounts receivable (normalized by sales) and accounts payable (normalized by assets), respectively (Petersen and Rajan, 1997; Niskanen and Niskanen, 2006; Garcia-Teruel and Martinez-Solano, 2010).

[2] Specifically, the firms in the sample met the following conditions: (1) under 250 employees; (2) an annual turnover of up to €50 million; (3) total assets of up to €43 million; (4) not classified as a microenterprise (i.e., under 10 employees and an annual turnover or total assets of up to €2 million).

We considered the following models to investigate trade credit determinants:

$$RECEIV_{it} = \alpha_0 + \alpha_1 X_{it} + \alpha_2 Y_{it} + \varphi_i + \lambda_t + \mu_i + \epsilon_{it}, \quad (1)$$
$$PAYAB_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 Z_{it} + \varphi_i + \lambda_t + \mu_i + \epsilon_{it}, \quad (2)$$

where $RECEIV_{it}$ represents the trade credit granted by firm i at time t to its customers, calculated as the ratio of accounts receivable to sales; and $PAYAB_{it}$ the finance received from its suppliers, defined as the ratio of accounts payable to total assets.

Regarding the explanatory variables that may simultaneously impact accounts receivable and accounts payable, X_{it}, we first use size and age as proxies for the firm's creditworthiness and, therefore, its ability to access alternative sources of finance. Size (LSIZE) and age (LAGE) are calculated as the logarithm of book value of assets and (1+age), respectively, where age is the number of years since the firm was incorporated. Typically, both larger and older firms have better creditworthiness and consequently easier access to finance than smaller and younger firms (Carreira and Silva, 2010). Consequently, these firms are likely to grant more credit to their customers and to use less credit from their suppliers as they have other sources of finance to fall back on (Schwartz, 1974; Petersen and Rajan, 1997). Conversely, it can be argued that larger and older firms generally have better trade reputations and are therefore less likely to be forced to offer credit to their customers to guarantee their products (Long et al., 1993). In addition, larger firms may have greater relative bargaining power in trade relations between suppliers and customers, allowing them to impose stricter payment terms on their customers. Larger and older firms are also offered trade credit more often due to their better creditworthiness. Although size and age may affect trade credit in different directions, we generally expect a positive relationship between accounts receivable and both variables, and a negative relationship in the case of accounts payable.

To control for the firm's ability to generate internal resources, we use the cash flow, defined as the ratio of net profits plus depreciation to sales/assets for accounts receivable/payable (CFLOW1 and CFLOW2, respectively). Firms with greater internal cash tend to grant more credit to their customers and need less external financing and therefore have lower accounts payable (Garcia-Teruel and Martinez-Solano, 2010). Thus, the relationship between internal financing and accounts receivable is expected to be positive, but negative in regard to accounts payable.

To control for the cost of external finance, we use the cost of financial debt (FCOST), defined as the ratio of finance costs to external financing excluding trade creditors. High financial costs lead firms to have less incentive to grant financing to their customers and more incentives to demand financing from their suppliers. So, we expect the cost of financial debt to be related negatively with accounts receivable and positively with accounts payable.

To capture the effect of possible shocks in sales on trade credit, we use the annual sales growth rate (GROWTH). A firm willing to grow may choose a strategy of granting more trade credit. Thus, growth should be positively related to accounts receivable. However, a firm whose sales are declining may also react by offering more trade credit to enhance their sales (Petersen and Rajan, 1997). To address these contradictory effects, we divide the variable into PGROWTH, which equals GROWTH when sales growth is positive and zero otherwise, and NGROWTH, which equals the absolute value of GROWTH when growth

is negative and zero otherwise (Petersen and Rajan, 1997; Niskanen and Niskanen, 2006; Garcia-Teruel and Martinez-Solano, 2010). Despite the contradiction in the above arguments about the effect associated with declining sales, we expect a positive relationship between accounts receivable and both growth variables.

Growing firms have more investment opportunities, so they will have an increased demand for funds and consequently for trade credit. However, the effect depends on the substitution or complementarity between bank credit and trade credit, as sales growth is also a positive signal for the health of firms. Nevertheless, we expect a positive relationship between accounts payable and positive growth, and a negative relationship in the case of negative growth.

The second set of covariates, Y_{it}, comprises three specific independent variables to trade credit received. First, to measure the ability of a firm to access external financing, we include the short-term finance (STLEV), calculated as the ratio of current liabilities to sales. This variable can be interpreted in much the same way as the creditworthiness, that is, we expect firms that are able to obtain more short-term resources to also be able to grant more credit to their customers.

Trade credit can also be used to transmit information about the quality of products. Buyers consider trade credit extension as a signal of trust, as the credit period gives them time to assess product quality before paying (Long et al., 1993). To capture this effect, we use the ratio of sales to assets, deducting accounts receivable (TURN) (Garcia-Teruel and Martinez-Solano, 2010). We expect a negative relationship, as firms with lower sales turnover produce higher quality goods. However, we should also note that larger firms, which generally have a better reputation, may not need to signal the quality of their products by granting more commercial credit (Long et al., 1993; Garcia-Teruel and Martinez-Solano, 2010).

Firms with larger operating margins have a greater incentive to increase sales by extending trade credit. The high profit margin offsets the financial cost of offering extra trade credit. Thus, firms can use trade credit as a price discrimination mechanism, which can also help firms keep a long-term relationship with customers (Petersen and Rajan, 1997; Niskanen and Niskanen, 2006). The variable operating margins is calculated as the ratio of gross profit to sales (MARGIN).

Finally, the third set of covariates, Z_{it}, includes three specific independent variables for accounts payable. First, to assess the substitution or complementarity between bank loans and accounts payable, we include the short-term financial debt (STFIND), measured as the ratio of short-term financial debt to assets (Burkart and Ellingsen, 2004). To test whether there is a substitution effect between long-term debt and debt provided by the suppliers, we also include the variable long-term debt (LTDEBT), defined as the ratio of long-term debt to assets. If bank loans and accounts payable were substitutable, we expect to observe a negative link between this variable and accounts payable ratio.

Firms tend to match the maturity of their liabilities and the liquidity of their assets (Morris, 1976). To control this effect, we introduce the ratio of current assets to total assets (CURRAS) as one of the independent variables. We expect firms that have invested more in current assets to use more short-term finance in general, and more trade credit, in particular.

We also include industry dummies ($_i$) at the two-digit NACE level to control for the well-known impact of industry structures. Indeed, empirical evidence shows that trade credit terms vary widely across industries but have only limited variation within industries

(Petersen and Rajan, 1997; Ng et al., 1999). Furthermore, we include time dummies (λ_t) to capture the influence of macroeconomic factors (e.g. credit rationing) that may affect the decision to grant or use trade credit (Casey and O'Toole, 2014). Finally, parameter $_i$ is the unobservable individual effect to control for the unique characteristics of each firm, and $_{it}$ is the random disturbance.

Tables A1 and A2 in the Appendix report the descriptive statistics and the correlation matrix of covariates, respectively.

4. Results

4.1. The use of trade credit by portuguese smes

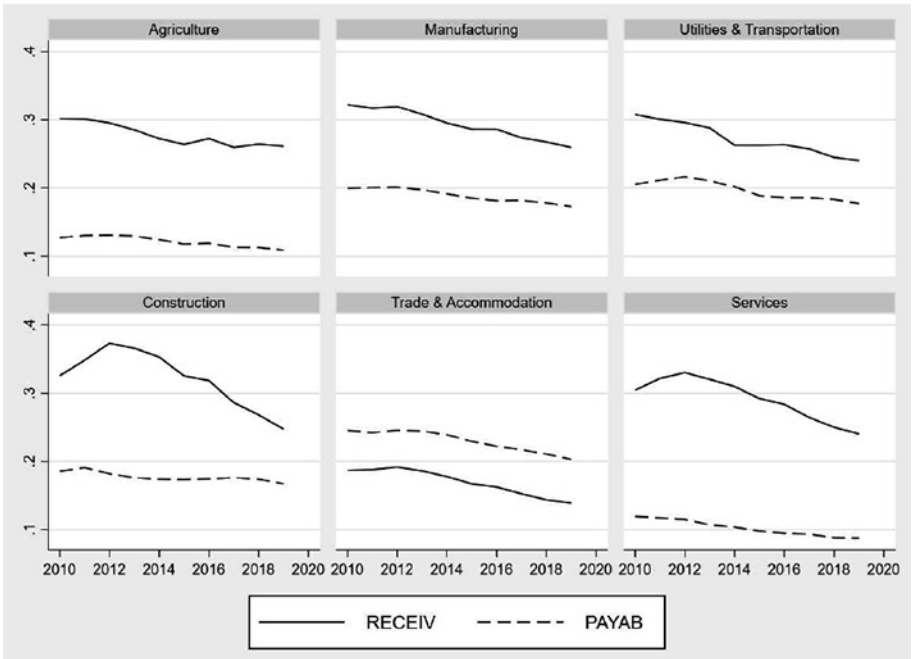
As can be seen in Table A1 in the Appendix, trade credit is an important source of external financing. The accounts receivable represent, on average, about a quarter of sales (25.2%), which is broadly in line with the 26.5% reported by Garcia-Teruel and Martinez-Solano (2010) for Spain in the period 1996–2002. It is noteworthy that, according to these authors, trade credit granted to customers is much higher in the Euro-Mediterranean countries than in the Nordic countries (Greece has the highest rate, at 33.1%, while the lowest rate is in Finland, at 9.2%).

Regarding the accounts payable, we observe that they represent about 18.3% of assets. This value is higher than the mean of the other forms of financial debt, including short-term financial debt (about 8.3%) and long-term debt (15.8%), which reveals the importance of supplier financing for firms (Table A1 in the Appendix). However, finance received from suppliers in Portugal is relatively lower than the average figures documented by Garcia-Teruel and Martinez-Solano (2010) for other Euro-Mediterranean countries (ranging from 24.9% in Spain to 28.5% in France). In the Scandinavian countries, by contrast, the level of accounts payable is somewhat lower (13.2% for Finland and 16.4% for Sweden).

The trade credit granted and received varies considerably across industries. Figure 1 shows the evolution of the trade credit over the 10 years of the sample (2010–2019) by industry. *Construction* has the highest average level of accounts receivable (at 32.1% of sales), followed by *Manufacturing* and *Services* (with 29.3% and 29.2%, respectively), while the lowest figure is seen in *Trade and Accommodation* (at 16.9%). In contrast, *Trade and Accommodation* presents the highest average accounts payable (at 23.0% of assets), while the lowest values are in *Services* and *Agriculture* (at 10.2% and 12.1%, respectively). Thus, firms in *Trade and Accommodation* make most use of financing from suppliers, while they grant the least credit to their customers. These results are broadly consistent with those of Garcia-Teruel and Martinez-Solano (2010).

Both measures of trade credit follow the same downward trend over the sample period. Specifically, on average, accounts receivable (payable) have declined by 7.0 (2.9) percentage points between 2012 and 2019.

Figure 1: Trade credit by industry, 2010-2019



Notes: Annual means. RECEIV is the ratio of accounts receivable (*i.e.* finance granted to customers) to sales; PAYAB is the ratio of accounts payable (*i.e.* finance received from suppliers) to total assets.

4.2. Determinants of trade credit

Table 1 reports the results of Models (1) and (2), accounts receivable and accounts payable, respectively. The two estimations have been performed using the fixed effect model because, first, the Breusch-Pagan test identifies the existence of individual effects (*i.e.* rejects the null hypothesis that the preferred model is pooled OLS) and, second, the Hausman test rejects random effects in favor of the fixed effects model. Moreover, in both cases, the *F*-test rejects the null hypothesis of joint insignificance of the coefficients at the 1% level.[3]

[3] Note that Petersen and Rajan (1997), Delannay and Weill (2004) and Niskanen and Niskanen (2006), *e.g.*, obtain an R^2 of similar magnitude to ours.

Table 1: Determinants of trade credit

Variables	Model (1)	Model (2)
	Accounts receivable	Accounts payable
lnSIZE	0.063*** (0.001)	-0.017*** (0.001)
lnAGE	0.026*** (0.002)	-0.030*** (0.001)
CFLOW1	-0.024*** (0.001)	
CFLOW2		-0.172*** (0.001)
FCOST	-0.248*** (0.010)	0.231*** (0.006)
PGROWTH	-0.003*** (0.000)	0.002*** (0.000)
NGROWTH (absolute value)	0.176*** (0.002)	-0.035*** (0.001)
STLEV	0.003*** (0.000)	
TURN	0.006*** (0.000)	
MARGIN	0.020*** (0.001)	
STFIND		-0.087*** (0.002)
LTDEBT		-0.084*** (0.001)
CURRAS		0.066*** (0.001)
Constant	-0.730*** (0.015)	0.501*** (0.010)
Industry dummy	YES	YES
Year dummy	YES	YES
No. of observations	423,467	423,467
No. of firms	80,921	80,921
R^2 (overall)	0.087	0.120
F statistic	467.98***	382.19***

Notes: Fixed-effects regressions of Models (1) and (2), respectively, accounts receivable and accounts payable. RECEIV – ratio of accounts receivable to sales; PAYAB – ratio of accounts payable to total assets; lnSIZE – log of assets; lnAGE – log of firm age; CFLOW1 and CFLOW2 – ratio of net profits plus depreciation to sales and assets, respectively; FCOST – ratio of finance costs to financial debt; GROWTH – annual sales growth rate; STLEV – ratio of current liabilities to sales; STFIND – ratio of short-term financial debt to assets; LTDEBT – ratio of long-term debt to assets; TURN – turnover of sales over assets; MARGIN – ratio of gross profit to sales; CURRAS – ratio of current assets to total assets. Coefficients of industry (two-digit level NACE-Rev.2 classification) and time (2010–2019) dummies not reported (in both cases, the *F*-test rejects the null hypothesis that the dummy coefficients are jointly equal to zero at the 1% level). Firm-cluster robust standard errors are given in parentheses. ***, ** and * statistical significance at the 0.01, 0.05 and 0.10 levels, respectively.

Firm size and age seem to be a determinant factor of the trade credit. Indeed, as expected, we found a positive (negative) and significant relationship between accounts receivable (payable) and both size and age. A firm with €3.30 million in assets (the 75th percentile) grants 12.4% more of its sales in trade credit and uses 3.4% less credit from its suppliers than a firm with €0.46 million in assets (the 25th percentile). Increasing the firm's age from eight to 25 years old (25th and 75th percentiles) increases (decreases) the ratio of accounts receivable (payable) by 2.7 (3.1) percentage points. These results suggest that larger and older firms are more likely to benefit from access to bank credit due to their higher creditworthiness and are more willing to provide trade credit to their customers. While this last

finding supports the financial motive for trade credit, it does not support the commercial motive, according to which firms use their greater bargaining power in trade negotiations.

Surprisingly, the capacity to generate internal funds (CFLOW) is negatively correlated with accounts receivable. We expected that firms with more internal cash would be able to extend more credit to their customers. Given that, we examined in more detail the effect of this variable on a firm's decision to finance its customers by splitting the internal resources generated into positive and negative cash flows (the latter in absolute values). Now we find significantly positive coefficients (PCFLOW=0.018 and NCFLOW=0.034; regression not reported) indicating different motives for trade credit between profitable and unprofitable firms. Indeed, as expected, the most profitable firms tend to extend more credit to their customers. But the unprofitable firms also tend to extend more credit, which can be explained by the fact that distressed firms use the extension of credit to attempt to maintain their sales. These firms are also in a worse bargaining position and are then unable to obtain fast payment from their customers (Petersen and Rajan, 1997).

To explore this further, we also divided losses into those when the firm has positive sales growth and losses when the firm has negative sales growth. The positive coefficient for the former is larger than for the latter. So firms that grow fast (and incur losses) seem to extend more credit ("buy" sales), but distressed firms (negative sales growth and negative income) also offer more trade credit, which seems to support the argument that debtors are less willing to repay distressed firms. Finally, when we include in the regression the square of CFLOW, both terms are statistically significant, depicting a U-shaped relationship across the entire range of data (i.e. the most profitable and the most unprofitable firms tend to grant more credit).[4]

Since a firm's ability to extend credit depends on its ability to raise funds, not only internally but also externally, we also control for the availability and cost of external financing. The coefficients of short-term financing (STLEV) and cost of financing (FCOST) are positive and negative, respectively, indicating that firms with greater access to short-term financing and cheaper external financing provide more financing to their customers.

In the case of accounts payable, the results confirm a substitution effect between supplier-provided credit and other sources of financing (internal and external). First, there is an inverse relationship between credit received from suppliers and resources generated internally (CFLOW). That is, as the ability to generate internal funds increases, firms tend to reduce their use of trade credit received. Second, short-term financial debt (STFIND) is significantly negative. Thus, the firms reduce the weight of accounts payable when they have access to other short-term financial resources. Third, the coefficient of long-term debt (LTDEBT) is also negative, again supporting the substitution hypothesis. Finally, as also expected, the relationship between accounts payable and financing costs (FCOST) is positive, which means that firms that incur higher costs in their external financing tend to resort to more financing from their suppliers.

Firms which have had positive sales growth (PGROWTH) report slightly fewer receivables (the coefficient is significantly negative, but economically small). This suggests that these firms are less dependent on their customers and consequently can influence the commercial

[4] These results are available from the authors upon request.

negotiations in their favor by reducing delays of payment. In contrast, firms whose sales have declined increase the proportion of financed sales (note that NGROWTH is defined in absolute value). Thus, firms try to limit the decline of their sales by offering more favorable terms of payment. In particular, for each euro less in sales, they grant more credit to their customers by about 17.6 cents. This result suggests that firms are mainly using trade credit as a marketing tool to improve their sales figures.

The level of accounts payable is positively affected by positive sales growth. Thus, firms with growth opportunities, which consequently have a higher demand for funds to invest, rely on the support of their suppliers to finance this growth. On the other hand, firms whose sales fall have lower accounts payable. This means that suppliers act as typical financial intermediaries and try to limit their risk as they tend to reduce the amount of credit granted to customers in trouble.

Regarding the effect of the firm's gross profit margin (MARGIN) on trade credit granted, the positive sign of the estimated coefficient seems to confirm the price discrimination theory. Indeed, firms that charge high prices (hence high margins) seem to use trade credit as a strategic tool to increase sales.

The results obtained do not allow us to support the quality-signaling hypothesis of Long et al. (1993). In fact, contrary to our expectations, we found a positive relationship between accounts receivable and TURN. This suggests that firms mainly sell products, the quality of which does not need to be transmitted, by extending more trade credit, which is consistent with the previously found result of the reputation of larger and older firms.

Firms attempt to match the maturities of assets and liabilities. The relationship found between the accounts payable and the weight of current assets (CURRAS) is positive, meaning that firms that invest more in current (short-term) assets tend to use more current debt such as trade credit.

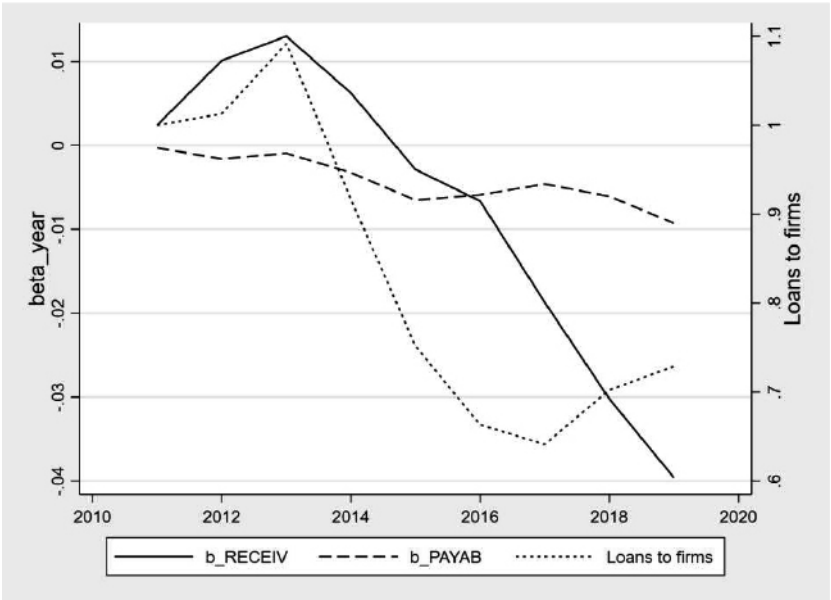
As can be seen in Tables A3 and A4 in the Appendix, the patterns of determinants of accounts receivable and accounts payable are robust to the industry disaggregation, with minor differences. Indeed, the motives behind a firm's decision to offer trade credit seem to be similar regardless of the firm's industry.

4.3. Bank lending constraints and trade credit

After the 2008 global financial crisis and the 2010–2014 Eurozone debt crisis, bank lending has been in sharp decline—by 41% between 2013 and 2017 (Figure 2).[5] Year dummies allow us to test whether firms experiencing bank lending constraints are more likely to use and grant trade credit.

[5] The severe recession following the 2008 global financial crisis left numerous European banks with non-performing loans (NPLs). In reaction, the European Banking Authority (EBA) and the European Central Bank (ECB) increased the banks' capital requirement in 2011 and deployed a series of actions to strengthen the prudential supervision of credit institutions in the Eurozone, namely the creation of a Single Supervisory Mechanism of banks in 2013 and the adoption of EBA definition of NPLs for the assessment of bank health in 2015 (Blattner et al., 2023).

Figure 2. Estimated coefficients of year dummies and bank loans to firms



Notes: b_RECEIV and b_PAYAB report the estimated coefficients of year dummies of accounts receivable and accounts payable estimations, respectively. Loans to firms is the index (2011=1) of the amount of bank loans to firms (source: Banco de Portugal).

We would expect that when bank credit is rationed, firms are more likely to use other sources of finance, including trade credit (Danielson and Scott, 2004; Casey and O'Toole, 2014). As can be seen in Figure 2, surprisingly, there is a slight negative impact on the financing received from suppliers over the decade. In particular, all else being constant, the accounts payable ratio decreases by 0.9 percentage points from 2010 to 2019. However, it should be noted that the amount of accounts payable depend not only on the demand of the firm but also on the supply of trade credit to the firm (Petersen and Rajan, 1997), which has decreased significantly over the decade (Figure 1).

We also find that there is a positive effect of the year on accounts receivable during the crisis, followed by an increasingly negative effect after the crisis period—all else remaining constant, the accounts receivable ratio falls by 5.3 percentage points from 2013 to 2019. Therefore, as bank credit shrinks, firms appear to extend less trade credit to their customers, which is consistent with the redistribution view of trade credit provision, whereby bank credit is redistributed from financially stronger firms to weaker firms via trade credit (Love et al., 2007).

5. **Conclusion**

This paper provides an empirical examination of the determinants of the trade credit policies of Portuguese firms. Using panel data of small and medium-sized firms for the period 2010–2019, we find that trade credit is an important source of external resources, financing about 18.3% of assets vis-à-vis to 15.8% and 8.3% from long-term and short-term financial debt, respectively. Portuguese SMEs also invest about a quarter of their sales in accounts receivable.

Our results seem to support the theory of financial motives for the use of trade credit. Indeed, we find that firms that have easier access to external financing at lower costs grant more trade credit to their customers (financial intermediation), while they rely less on trade credit from their suppliers (substitution effect). Firms that generate more (positive) internal resources also extend more credit to their customers and receive less credit from their suppliers. Moreover, firms with growing sales tend to rely on the support of their suppliers to finance new investments, namely in inventories, while firms whose sales decline receive less financial support from suppliers, which seems to provide further arguments for the theory that suppliers act as typical financial intermediaries.

The data do not seem to support the hypothesis of the use of trade credit as a way of transmitting information about the quality of the firm's products. However, in the case of the price discrimination theory, trade credit seems to be an appropriate marketing tool. Moreover, firms facing a decline in sales and negative internal financing respond by increasing the credit granted to customers in an attempt to stem falling sales.

Our results also show that the trade credit decisions made by firms are generally influenced by the same factors, regardless of the industry in which they operate. Finally, we find an increase in credit extended to customers to at the peak of 2008 financial crisis, followed by a subsequent collapse of this source of financing right after the crisis, which appears to mimic the contraction in bank credit in the Portuguese economy.

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Appendix

Table A1: Descriptive statistics

Variables	N	Mean	Std. Dev.	Min.	Max.
RECEIV	488,694	0.252	0.263	0	1
PAYAB	488,694	0.183	0.195	0	1
lnSIZE	488,694	14.020	1.457	0	17.577
lnAGE	488,694	2.646	0.862	0	5.323
CFLOW1	488,694	0.033	0.622	-4.023	3.169
CFLOW2	488,694	0.045	0.166	-0.898	0.475
FCOST	488,694	0.024	0.032	0	0.192
GROWTH	423,467	0.132	0.726	-1.000	5.431
STLEV	488,694	2.278	10.190	0	87.910
STFIND	488,694	0.083	0.150	0	1
LTDEBT	488,694	0.158	0.221	0	1
TURN	488,694	2.729	3.980	0.000	27.290
MARGIN	488,694	0.097	0.615	-2.999	4.063
CURRAS	488,694	0.671	0.281	0	1

Notes: Pooled yearly values, 2010–2019. RECEIV – ratio of accounts receivable to sales; PAYAB – ratio of accounts payable to total assets; lnSIZE – log of assets; lnAGE – log of firm age; CFLOW1 and CFLOW2 – ratio of net profits plus depreciation to sales and assets, respectively; FCOST – ratio of finance costs to financial debt; GROWTH – annual sales growth rate; STLEV – ratio of current liabilities to sales; STFIND – ratio of short-term financial debt to assets; LTDEBT – ratio of long-term debt to assets; TURN – turnover of sales over assets; MARGIN – ratio of gross profit to sales; CURRAS – ratio of current assets to total assets.

Table A2: Correlation across covariates

Variable	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
[1] RECEIV	1												
[2] PAYAB	0.040*	1											
[3] lnSIZE	0.208*	-0.110*	1										
[4] lnAGE	0.119*	-0.109*	0.318*	1									
[5] CFLOW1	-0.051*	-0.081*	0.059*	0.027*	1								
[6] CFLOW2	-0.07*	-0.209*	0.010*	0.023*	0.331*	1							
[7] FCOST	0.030*	0.121*	0.060*	0.068*	-0.018*	-0.019*	1						
[8] GROWTH	-0.104*	-0.037*	0.053*	-0.154*	0.048*	0.065*	-0.027*	1					
[9] STLEV	0.167*	-0.089*	0.179*	-0.026*	-0.206*	-0.081*	-0.065*	-0.034*	1				
[10] TURN	-0.071*	0.287*	-0.370*	-0.205*	-0.019*	-0.039*	0.013*	0.029*	-0.129*	1			
[11] MARGIN	-0.007*	-0.139*	0.142*	0.017*	0.890*	0.308*	-0.001	0.042*	0.009*	-0.074*	1		
[12] STFIND	0.042*	0.010*	0.137*	0.054*	-0.068*	-0.116*	0.123*	-0.017*	0.113*	-0.047*	-0.047*	1	
[13] LTDEBT	-0.037*	-0.136*	0.096*	-0.029*	-0.091*	-0.149*	0.034*	0.044*	0.018*	-0.151*	-0.020*	-0.120*	1
[14] CURRAS	0.163*	0.254*	-0.198*	-0.032*	-0.105*	-0.008*	0.024*	-0.005*	-0.087*	0.315*	-0.158*	-0.042*	-0.270*

Notes: See notes to Table A1. * Statistical significance at the 0.05 level.

Table A3: Determinants of accounts receivable by industry

Variables	Agriculture (1)	Manufacturing (2)	Utilities & Transportation (3)	Construction (4)	Trade & Accommodation (5)	Other Services (6)
lnSIZE	0.060*** (0.006)	0.089*** (0.001)	0.091*** (0.003)	0.071*** (0.002)	0.047*** (0.001)	0.056*** (0.002)
lnAGE	0.044*** (0.013)	0.020*** (0.003)	0.002 (0.007)	0.040*** (0.007)	0.013*** (0.002)	0.014** (0.006)
CFLOW1	-0.034*** (0.006)	-0.050*** (0.005)	0.019*** (0.007)	-0.014*** (0.003)	-0.055*** (0.003)	-0.019*** (0.002)
FCOST	-0.189** (0.081)	-0.282*** (0.017)	-0.201*** (0.038)	-0.404*** (0.031)	-0.169*** (0.011)	-0.190*** (0.034)
PGROWTH	-0.006*** (0.002)	-0.006*** (0.001)	-0.001 (0.002)	-0.001 (0.001)	-0.002*** (0.001)	-0.006*** (0.001)
NGROWTH	0.146*** (0.011)	0.206*** (0.003)	0.243*** (0.008)	0.191*** (0.004)	0.163*** (0.002)	0.136*** (0.004)
STLEV	0.001*** (0.000)	0.004*** (0.000)	0.005*** (0.000)	0.003*** (0.000)	0.004***(0.000)	0.003*** (0.000)
TURN	0.009*** (0.001)	0.010*** (0.000)	0.006*** (0.000)	0.006*** (0.000)	0.003*** (0.000)	0.005*** (0.000)
MARGIN	0.037*** (0.006)	0.034*** (0.005)	-0.009 (0.007)	0.015*** (0.003)	0.048*** (0.003)	0.018*** (0.002)
Constant	-0.710*** (0.087)	-1.021*** (0.019)	-1.064*** (0.043)	-0.817*** (0.034)	-0.545*** (0.014)	-0.601*** (0.033)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	14,443	114,234	23,033	58,348	143,068	70,341
No. of firms	2,783	19,083	4,080	13,731	27,058	15,435
R^2 (overall)	0.083	0.109	0.122	0.146	0.210	0.081
F statistic	35.26***	749.11***	146.09***	423.90***	769.98***	267.59***

Notes: Fixed-effects regression of Model (1). See notes to Table 1. Coefficients of time (2010–2019) dummies not reported. Firm-cluster robust standard errors are given in parentheses. ***, ** and * statistical significance at the 0.01, 0.05 and 0.10 levels, respectively.

Table A4: Determinants of accounts payable by industry

Variables	Agriculture (1)	Manufacturing (2)	Utilities & Transportation (3)	Construction (4)	Trade & Accommodation (5)	Other Services (6)
lnSIZE	0.004* (0.002)	-0.029*** (0.001)	-0.010*** (0.002)	0.001 (0.001)	-0.024*** (0.001)	-0.010*** (0.001)
lnAGE	-0.020*** (0.005)	-0.025*** (0.002)	-0.017*** (0.006)	-0.024*** (0.004)	-0.047*** (0.002)	-0.004 (0.003)
CFLOW2	-0.106*** (0.007)	-0.174*** (0.003)	-0.211*** (0.007)	-0.201*** (0.004)	-0.191*** (0.003)	-0.120*** (0.003)
FCOST	0.170*** (0.032)	0.223*** (0.012)	0.305*** (0.029)	0.162*** (0.016)	0.291*** (0.012)	0.135*** (0.015)
PGROWTH	-0.000 (0.001)	0.009*** (0.001)	0.007*** (0.002)	0.002*** (0.001)	0.003*** (0.001)	0.001** (0.000)
NGROWTH	-0.017*** (0.004)	-0.048*** (0.002)	-0.046*** (0.006)	-0.021*** (0.002)	-0.074*** (0.003)	-0.013*** (0.002)
STFIND	-0.056*** (0.007)	-0.074*** (0.003)	-0.116*** (0.007)	-0.069*** (0.005)	-0.124*** (0.003)	-0.039*** (0.003)
LTDEBT	-0.060*** (0.006)	-0.085*** (0.003)	-0.130*** (0.006)	-0.079*** (0.004)	-0.103*** (0.003)	-0.040*** (0.003)
CURRAS	0.046*** (0.006)	0.059*** (0.003)	0.094*** (0.006)	0.064*** (0.004)	0.076*** (0.003)	0.048*** (0.003)
Constant	0.118*** (0.033)	0.645*** (0.013)	0.373*** (0.032)	0.200*** (0.018)	0.679*** (0.013)	0.256*** (0.014)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	14,443	114,234	23,033	58,348	143,068	70,341
No. of firms	2,783	19,083	4,080	13,731	27,058	15,435
R^2 (overall)	0.106	0.103	0.213	0.110	0.137	0.116
F statistic	25.49	609.38	124.57	197.89	741.31	154.83

Notes: Fixed-effects regression of Model (2). See notes to Table 1. Coefficients of time (2010–2019) dummies not reported. Firm-cluster robust standard errors are given in parentheses. ***, ** and * statistical significance at the 0.01, 0.05 and 0.10 levels, respectively.